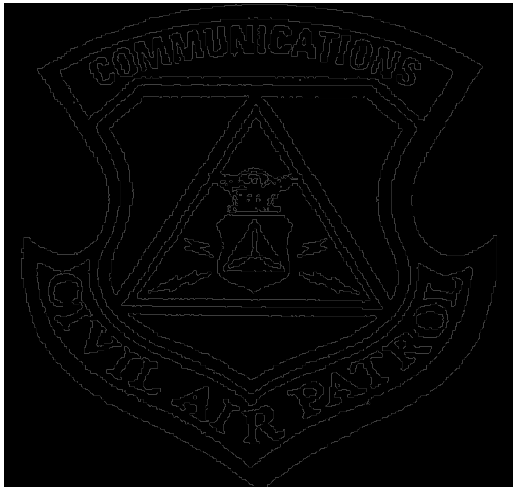
Civil Air Patrol
Combined Basic / Advanced Communications User Training (BCUT / ACUT)



Voice of Command

Capt Derrell Lipman,
LtCol Frank Pocher Minute Man Squadron
Some slides courtesy of
LTC Bruce Bream
Ohio Wing/Group IV

Radio Operator Training and Requirements

- Basic Communications User Training (BCUT)
- Advanced Communications User Training (ACUT)
- This course covers both

Basic Communications User Training (BCUT)

- Calling and answering
- Use of call signs
- Operating the radio
- Basic prowords
- Prohibitions
- National communications policies
- Local operating procedures
- Location and use of local repeaters
- Local operating practices
- Local net schedules
- No test is required.

Advanced Communications User Training (ACUT)

- Network operating procedures
- Formal message preparation and handling
- Familiarity with different radio modes and equipment (e.g. HF, VHF, SSB, FM)
- Working knowledge of CAPR 100-1, Volume 1
- Basic orientation to digital radio operations
- Successful completion of the Advanced Communications User Test (open book)
- A passing score is 80%, corrected to 100%.

Radio Operator Authorization

- A permit allowing operation of a CAP radio unsupervised

CAP Communications Manuals and Guides

- CAPR 100-1 Volume 1: Communications
- Civil Air Patrol Radiotelephone Procedures Guide
  - until CAPR 100-1 Volumes 2 and 3 are released

Mission of CAP Communications

- The mission of the CAP Communications Program is to organize and maintain a reliable, nationwide, point-to-point, air-to-ground, and ground mobile radio capability in support of the missions of CAP.

Purposes of CAP Communications

- Primary Purpose of a CAP Communications Facility:
  - To provide the commander with the means for controlling his/her units and their activities
- Additional Purpose of a CAP Communications Facility:
  - To provide the commander at each echelon the ability to communicate with superior and subordinate commanders.

Uses of CAP Communications Facilities

- CAP Communications Facilities are used in support of:
  - Emergencies
  - Flying
  - Administration
  - Training
  - Support to Other Agencies

Principles of Civil Air Patrol Communications

- Survivability
- Reliability
- Flexibility
- Maintainability
- Speed
- Security

Operation of CAP Radio Stations by Unlicensed Personnel

- The operation of all CAP Radio Stations must be under the direct supervision of a properly licensed Civil Air Patrol radio operator.

Talking on the Radio

Radiotelephone Procedures

- Listen before transmitting.
- Clearly enunciate all words.
- Talk, don’t shout.
- End transmissions with proword:
  OVER, OUT, WAIT**,** or ***WAIT OUT***.
- Identify station at beginning and end of communication, and at least once per hour.
- Wait between transmissions, for emergency break-ins.
- Use CAP prowords, not amateur radio "Q" or "Z" signals nor police 10- series.
- Review message prior to transmission.

Spelling of Words and Initials

Letter	Word	Pronunciation
A	Alpha	**Al Fah**
B	Bravo	**Bra Voh**
C	Charlie	**Char Lee**
D	Delta	**Dell Tah**
E	Echo	**Eck Oh**
F	Foxtrot	**Foks Trot**
G	Golf	**Golf**
H	Hotel	**Hoh Tell**
I	India	**In Dee Ah**
J	Juliet	**Jew Lee Et**
K	Kilo	**Key Loh**
L	Lima	**Lee Mah**
M	Mike	**Mike**

Letter	Word	Pronunciation
N	November	**No Vem Ber**
O	Oscar	**Oss Cah**
P	Papa	**Pah Pah**
Q	Quebec	**Keh Beck**
R	Romeo	**Row Me Oh**
S	Sierra	**See Air Rah**
T	Tango	**Tan Go**
U	Uniform	**You Nee Form**
V	Victor	**Vik Tah**
W	Whiskey	**Wiss Key**
X	Xray	**Ecks Ray**
Y	Yankee	**Yang Kee**
Z	Zulu	**Zoo Loo**

Pronunciation of Numbers

Digit	Spoken As	Example	Spoken As
0	Zero	13	Wun Thu Ree
1	Wun	19	Wun Niner
2	Too	44	Fo Wer Fo Wer
3	Thu Ree	90	Niner Zero
4	Fo Wer	136	Wun Thu Ree Six
5	Fi Yiv	500	Fi Yiv Hun Dred
6	Six	1478	Wun Fo Wer Seven Ate
7	Seven	2100	Too Wun Hun Dred
8	Ate	16000	Wun Six Thow Zand
9	Niner	81268	Ate Wun Too Six Ate

Prowords

- In order to create a standard terminology for CAP communicators, a set of prowords has been defined which are to be used whenever they are appropriate. Some prowords are for use only at certain times (for example "Disregard this Transmission"), while others are for use during normal radio conversation (e.g. Affirmative).

Establishing Communications

- Identify the station you wish to communicate with, followed by "this is" followed by your tactical call sign.
  - *Patriot 365, this is Patriot 461, over.*
- The response is normally the opposite of the initiating call.
  - *Patriot 461, this is Patriot 365, over.*

Emergency Communications

Distress and Emergency Signals

- CAP Communications personnel should be familiar with the international distress and emergency signals:
  - MAYDAY
  - PAN
  - SECURITE

False or Fraudulent Signals

- No person within the jurisdiction of the United States shall knowingly utter or transmit, or cause to be transmitted, any false or fraudulent signals of distress.

Operator's Responsibility

- Radio Operators involved under any conditions of emergency or distress communications will adhere to the following two basic rules of operating procedures:
- Listen before transmitting, ALWAYS.
  - Cooperate. Be prepared to offer assistance. However, remain off the air unless it is clearly determined that your station's services are needed.

Station Licensing
and
Use of Call Signs

National Telecommunications and Information Agency (NTIA)

- The federal agency responsible for the regulation and coordination of telecommunications among federal agencies is the National Telecommunications and Information Agency. CAP radio communications fall under this authority.

Station License

- CAP stations are authorized to operate as part of a *fleet* license, applicable, typically, to a wing.
- A station authorization for the *fleet*, must be on file somewhere in the unit. (If the fleet license is for the wing, then the station authorization must be on file somewhere in the wing.)

Federal Communications Commission (FCC)

- The federal agency responsible for the regulation and coordination of telecommunications among non-federal agencies is the Federal Communications Commission. Amateur radio falls under this category.
- CAP is specifically prohibited from using the frequencies in the amateur radio service (ham radio) to conduct CAP business including SAR/DR operations.

Communicating with Other Agencies

- CAP stations operating on non-CAP frequencies must have written authorization from the licensed agency.
- A copy of the FCC license or the federal authorization must also be obtained.

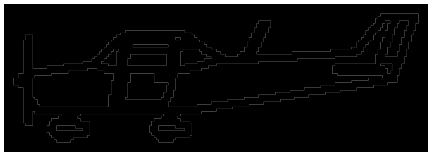
Types of Stations & Tactical Call Signs

MASSACHUSETTS WING CALL SIGN EXAMPLES

GROUND

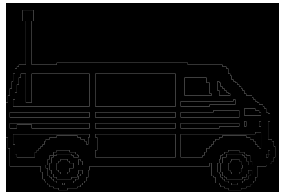
Patriot 40

AIRMOBILE



CAPFLIGHT 1921

MOBILE



Patriot 461

Voice Call Signs - Land fixed and mobile stations

- **Tactical call signs**
  - **e.g. Patriot 461**
- **Functional call signs**
  - **e.g. Minute Man Base, Ground Team 1**

Voice Call Signs - Air-mobile stations

- CAP corporate aircraft will use “CAPflight” (pronounced “Cap-Flight”) at all times.
- Member-owned aircraft may use an assigned CAPflight call sign when on reimbursable missions. At other times, member-owned aircraft should use an assigned tactical call sign as would be used by land stations.

Tactical call signs

- Composed of a word or short phrase, which identifies the wing or region, followed by a number, which uniquely identifies an individual, unit, or station.
- e.g. Massachusetts Wing uses the word *Patriot* for all MAWG stations. Patriot 461 is the call sign of an individual, unit, or station assigned by MAWG.

Staff assignment of call signs

- Wing or region (not group or squadron):
  - 1 Commander (e.g. Patriot 1)
  - 2 Vice commander
  - 3 Chief of staff
  - 4 Director of communications
  - 5 Chaplain

Local Procedures in MAWG

- Unit receives block of 20 or 40 call signs.
- Typical assignment:
  - 0 Unit radio (Minute Man is Patriot 460)
  - 1 Commander (Capt. Lipman is Patriot 461)
  - 2 Deputy Commander for Seniors
  - 3 Deputy Commander for Cadets
  - 4 Communications Officer
- Remainder assigned per unit whim

ES Mission Communications

- Communicators are needed for nearly all ES missions in CAP, both SAR and DR.
- Additional training is required to achieve a Radio Operator emergency services rating. This training is outlined in CAPR 50-15.

Why does radio work?

When I talk on the radio, how does my voice get from here to there???

Frequency

- Alternating Current (AC)
  - The terminals of the power supply change from positive to negative to positive and so on. AC flows first in one direction, then the other. The current alternates in direction.
  - The frequency of the AC is the number of complete cycles, or alternations, that occur in one second.
  - Measured in Hertz (Hz)

VHF - Very High Frequency

- Short-range, line-of-sight
- Allows for multiple conversations on the same frequency, throughout the country, concurrently.
- Provides excellent, dependable, short-range communications which are readily adaptable to ground and air mobile operation.

HF - High Frequency

- Can be Long-range (cross-country) or Medium-range.
- Travels long distances, so not appropriate for short-range communications.

Amplitude Modulation

- The process of varying the amplitude of a radio frequency carrier in response to the instantaneous changes in a signal source (e.g. voice).

Frequency Modulation

- The process of varying the frequency of a radio frequency carrier in response to the instantaneous changes in a signal source (e.g. voice).

Sidebands

- The sum or difference frequencies generated when an RF carrier is mixed with an audio signal.
- Single Sideband phone (SSB) signals have an upper sideband (USB -- that part of the signal above the carrier) and a lower sideband (LSB -- the part of the signal below the carrier).
- CAP HF frequencies primarily use USB.

Transmitter Power

- Radio operators should use the minimum power required for satisfactory operation.
- In particular, HF stations are limited to the minimum power required to establish communications.

Using a Radio

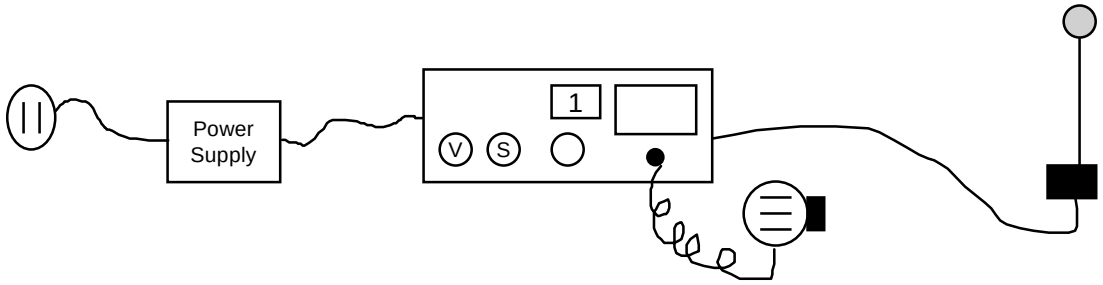
Radio Operation Summary

Common Controls:

- **Volume**
- **Squelch**
- **Channel Selector**
- **Mike with Push to Talk Switch**

Radio Setup

- **Radio Transceiver (VHF-FM, HF-SSB, SAR)**
- **Power Supply (110 VAC or 12 Volt DC)**
- **Antenna (Vertical, Magnetic Mount, Dipole)**



CAP VHF-FM Radio Operation

Normal Operation Setup Sequence

- **Power on**
- **Set channel - Channel 1 in display (148.15 MHz)**
- **Set volume, squelch**

Before Transmitting

- **Listen on Channel -- don't transmit if conversation is in progress**

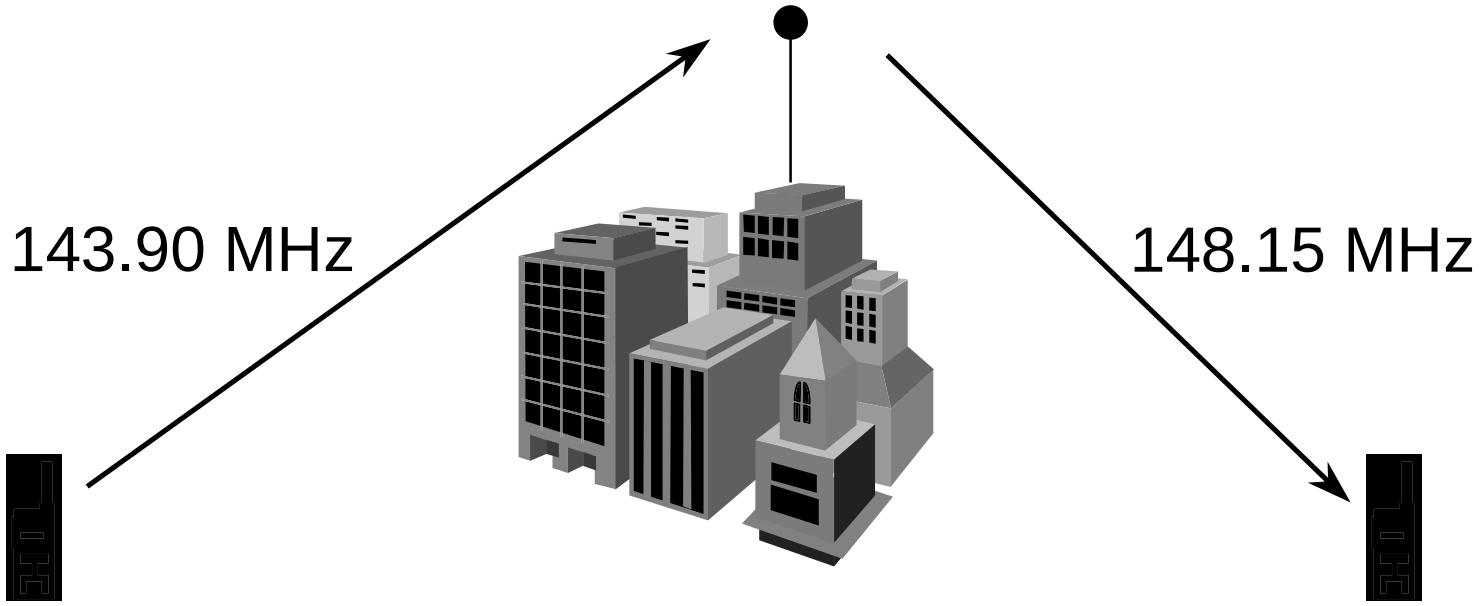
To Transmit

- **Press *push-to-talk* button**
- **Hold microphone about 1" from mouth**
- **Speak in a normal tone of voice**

Repeaters

Talking to people farther away

Repeater Operation



Repeater increases the range of mobile stations due to its high profile location

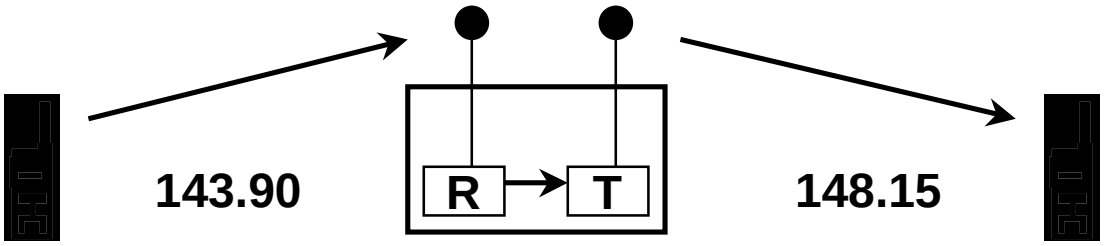
Voice Operating Modes

SIMPLEX

Single Frequency - One Station at a Time

REPEATER

Two Frequencies - One Station at a Time



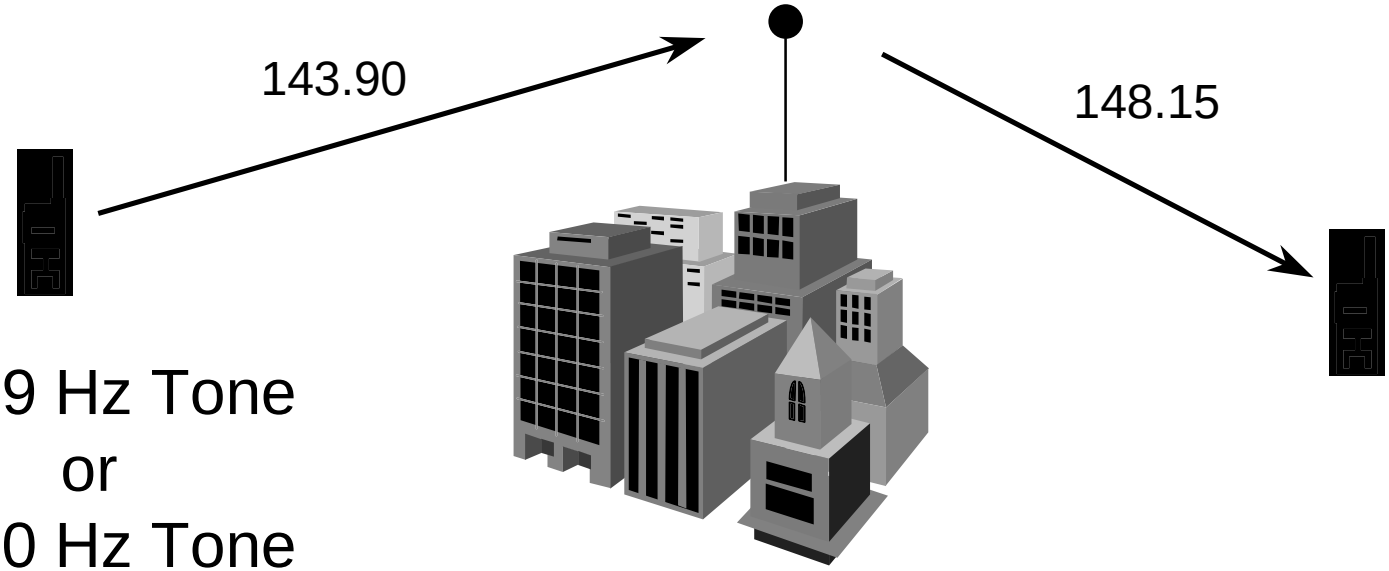
Selecting a particular repeater

- Repeaters are activated by PL (private line) Tones, aka CTCSS (Continuous tone-coded squelch system).
  - A subaudible tone system which, when added to a carrier, allows a receiver to "decide" to accept a signal.

The universal access tone.

- 100.0 Hz is a national "all-repeaters" tone
- Use for a short period of time, to contact a local station to determine the proper tone to use.
- Portable radios of 6 watts or less may use 100.0 Hz for routine operations only if the radio is incapable of using the primary discrete tone.

Repeater Operation



110.9 Hz Tone
or
100.0 Hz Tone

Universal Access Tone used by low power stations only

Note: All CAP Repeaters should respond to the 100.0 Hz tone. (Doesn't work yet in CAWG.)

Channel Assignments and Special Frequencies

National standard frequency and tone encode assignment

- All corporate VHF radios are mandated to have the following frequencies assigned to channels 1 - 4:
  - Channel 1 – 148.1500 MHz, simplex 100 Hz
  - Channel 2 – 148.1250 MHz, simplex 100 Hz
  - Channel 3 – 148.1375 MHz, simplex 100 Hz
  - Channel 4 – 149.5375 MHz, simplex 100 Hz
- It is also recommended that member-owned radios contain this same frequency assignment to channels, to ease operation.

MAWG frequency and tone encode assignment

– 5	Waltham / Westfield	Std	110.8 Hz
– 6	Danvers	Alt	114.8 Hz
– 7	Cape Cod	Alt	103.5 Hz
– 8	Bridgewater	Alt	110.9 Hz
– 9	Worcester	Std	114.8 Hz
– 10	Mt. Greylock	Std	103.5 Hz
– 11	Packet	149.895 MHz	

Std=148.15/143.90 MHz

Alt=148.125/143.75 MHz

National Calling Frequencies

- 4582.0 kHz and 7635.0 kHz
- Authorized for use by all CAP stations for communications concerning all matters relating to official CAP business
- Emergency operations will take precedence
- Middle East Region and Pacific Region are assigned 4582.0 kHz as their region alternate frequency, and have precedence over other stations on that frequency except emergency or mission communications.

Digital Communications

Digital Communications

- Digital communications refers to a radio communications system that uses computers and associated equipment to transfer messages and files across the country.

Packet Radio

- Packet Radio is transmission utilizing a standard method of data flow management or "protocol" titled X.25
- X.25 has been refined to allow computer controlled processing and transmission of digital text communications on radio circuits. This refinement to X.25 is called AX.25 (Amateur X.25).
- Allows rapid and error free transmission of data

Components of a Packet System

- Terminal Node Controller (TNC)
- Terminal Device
- Radio Transceiver

Terminal Node Controller (TNC)

- The interface between the user's terminal device and the transceiver.
- Often is a small computer to run the AX.25 protocol software.
- Accepts digital data from the terminal device, processes data, and assembles text into a "packet" of digital information which contains addressing, routing, text and error checking and correction information.

Terminal Device

- Displays and transmits ASCII characters and control codes.
- Human-to-machine interface
- May be a computer, either storing the messages coming into it, or, acting as a terminal to display the messages.

Radio Transceiver

- The interconnection between the TNC and the radio is very simple. It requires only a speaker audio signal from the radio, a microphone level input to the radio, and a push-to-talk line to allow keying of the transmitter.

Components of a Packet System

- Packet Bulletin Board System (PBBS)
  - A computer system used for storage and retrieval of message traffic.
  - Users leave addressed messages on the bulletin board and destination stations retrieve messages when they connect to the BBS.

Digital call signs

- Wing digital call signs are made up of the two-letter postal state identifier, followed by the assigned four digit number.
- Typically, the assigned four digit number is composed from the station call sign number, right justified, filled with leading zeros
- Example:
  - Massachusetts Wing "Patriot 461" would become MA0461

Digipeaters

- A digipeater operates on a single frequency, and is basically a "store and forward" device.
- By using the "digipeat" function, traffic can be relayed through an intermediate station's TNC without human intervention. This permits error-free transfer of messages that can span unlimited distances from origin to destination.

Communication Nets

Directed Net

- Stations obtain permission from the Net Control Station prior to communicating with other stations in the net.
- Often started with a roll call, to determine which members are monitoring the Net.
- Each station identifies itself, as called, with its CAP assigned tactical call sign.
- Following roll call, transmission of traffic occurs.
- Messages are transmitted in order of precedence.

Net Control Station (NCS)

- Controls and directs the flow of radio traffic within their Net.

Break-in Procedures

- Only emergency or urgent traffic justifies break-in procedures.
- A station wishing to break in will transmit at the pause with his/her station call sign.
- The word "Break" is not used as a break-in proword. This proword is used solely to separate message text from other portions of the message.

Types of Nets

- Command Net
- Communicators Net
- Chaplain's Net
- Special Purpose Nets
  - Mission Net
  - Training Net
- Regional Nets
- Wing Nets
- Group Nets
- Squadron Nets

Free Net

- In this net, the Net Control Station authorizes member stations to transmit traffic to other stations in the net without obtaining prior permission from the net control station.
- Free net operation does not relieve the NCS of the responsibility for maintaining circuit discipline.

NCS script

- Each wing has its own Net script
- Roll call
  - a list of call signs, in some wings (e.g. NHWG)
  - by Group, in some wings (e.g. CAWG)
  - MAWG procedure uses hundreds digit of call sign
    - e.g. *100 series stations* refers to all call signs between 100 - 199

Message Traffic

- Categories of Traffic
  - Formal Traffic
  - Administrative Traffic
  - Informal Traffic

Formal Traffic Message Form

- Formal message traffic is prepared on, and transmitted from CAP Form 4 or similar form.

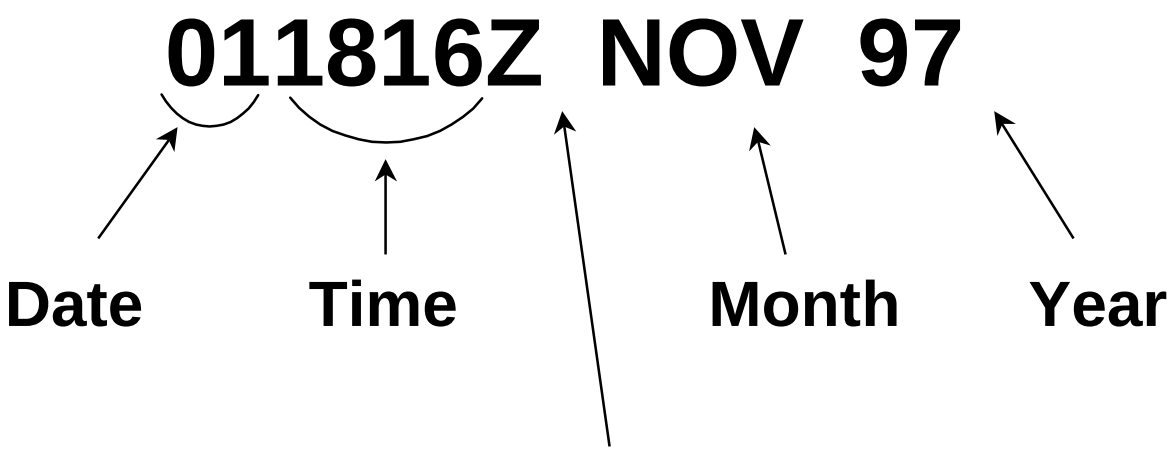
Message Precedence (PRECEDENCE)

- Precedence Designations
  - ROUTINE
  - PRIORITY
- Under no circumstances may the message precedence be changed without the permission of the originator.

Date Time Group (DTG)

- Indicates when the message was originated.
- Zulu Time is used (AKA Greenwich Mean Time and UTC (Universal Time Coordinated)
- Zulu time is five hours ahead of Eastern Standard Time; four hours ahead of Eastern Daylight Time. E.g. 1130 EST is 1630Z; 2215 EDT is 0215Z (the next day).

Format of the DTG



ZULU - Designates that time is UTC (Universal Coordinated Time)

Originator of Message (FROM)

- Includes the name of the headquarters of the originator, a "Slant Bar" ('/'), and the originator's office symbol, name, and/or duty.
- Examples:
  - From: HQ MAWG / CC
  - From: HQ LtCol Frank Pocher Minute Man Squadron / Project Officer SM Cross

Addressee (TO)

- This indicates the unit and name and/or office symbol of the addressee.
- Example
  - To: All Units, MAWG

Copies To (INFORMATION)

- The information line is used to indicate all additional units and/or personnel which the originator desires to receive a copy of the message.

Text of message

- The originator here states his/her message as clearly and briefly as possible

Radio Station Operator Information

- The radio station operator will complete the information on the time of receipt and time of transmission, at the bottom of the message form.

Corrections to a message

- If an error is made in transmission, it must be corrected before continuing, and speech will be stopped immediately.
- The proword "CORRECTION" is spoken, the last correct group or phrase is repeated, then the transmission continues with the correct version.
- No one but the originator has the authority to change any part of the message.

Acknowledgment of Receipt

- Acknowledgment of receipt will not be given until the receiving operator is satisfied that the transmitted message has been copied correctly.
- Example of acknowledgment
  - Roger your message, out.
- Messages which have been transmitted and acknowledged will be corrected by a subsequent, separate service message.

MAWG Net Schedule

- Nets are held at 8pm local, on:
  - Monday
  - Tuesday
  - Thursday
  - Friday
- Waltham or Worcester repeater
- All licensed operators may check in

Communications Awards, Activities and Programs

- The Communicator Badge
- The Senior Communicator Badge
- The Master Communicator Badge

See CAPR 100-1 for more details

Cadet Eligibility for Communicator Badge

- Cadets are encouraged to pursue each level of the communicator badges. To do so, cadets must meet all of the training requirements listed in the appropriate section of CAPP 214 with the exception of the portions specifically intended for the senior member training program.

Safety

First Aid Equipment

- A suggested list of first aid equipment which should be available at all Land radio stations is:
  - First Aid Kit
  - Safety Rope
  - Blanket
  - Flashlight
  - Walking Cane
  - Direct breathing resuscitation kit

Practice ELT’s

Emergency Locator Transmitters

- ELTs transmit on 121.5 MHz, 243 MHz, 406 MHz
- Practice ELTs traditionally operated on 121.6 MHz, but other frequencies are authorized.
- **Preferred** practice ELT frequency is **121.775 MHz**
- Practice ELT use on any authorized frequency other than 121.775 MHz requires notification of three different FAA offices prior to use.
- Practice ELT's operating on 121.775 MHz require no notice to the FAA prior to use.

Miscellaneous
Rules and Regulations

Out of Wing Operation

- Operation of mobile stations outside of the wing in which they are licensed is permitted.
- Operation on CAP frequencies in Canada and Mexico is prohibited.
- Before operating any radio in the states bordering Canada, you must check with the wing director of Communications to learn what the operating restrictions are.

Communications with Higher Headquarters

- Any problems or questions regarding CAP communications should be addressed to the next higher headquarters, as a first remedy.

Loss of Communications Privileges

- For reasonable cause, a wing or higher commander may terminate the privileges of any CAP member in his command to participate in CAP radio activities.

Hints for the Open-book Test

- Study CAPR 100-1
- The table of contents is your friend
- All but one answer are in CAPR 100-1
  - Even the one missing answer is implied
- Find <u>each and every</u> answer in the reg
  - Don’t mark an answer until you’ve found it!
  - Don’t mark an answer until you’ve found it!
  - Don’t mark an answer until you’ve found it!

The End